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BIOLOGICAL EVALUATION
WESTERN SPRUCE BUDWORM IMPACT EVALUATION
ON THE
TARGHEE NATIONAL FOREST
1976-1977

FOREST INSECT AND DISEASE MANAGEMENT
STATE AND PRIVATE FORESTRY
U.S. FOREST SERVICE
OGDEN, UTAH

BIOLOGICAL EVALUATION

Western Spruce Budworm Impact Evaluation On The
Targhee National Forest
1976-1977[1/]

INTRODUCTION

The western spruce budworm, Choristoneura occidentalis Free, has periodically infested Douglas-fir, subalpine fir and Engelmann spruce stands throughout the northern portions of the Targhee National Forest. In the early and mid 1950's, spruce budworm defoliation became rather extensive. In 1957, a total of 118,365 acres of budworm infestation was sprayed with one pound of DDT per acre. Excellent control was reportedly obtained, but due to the extent of the epidemic, some reinfestations occurred and new areas became infested. This infestation continued to increase in size and intensity until 1963 when approximately 200,000 acres were treated with one pound DDT per acre. Once again, excellent results were reported, but after one season the population again rose to approximately 98,000 acres.

In late 1965, increasing widespread spruce budworm defoliation on the Targhee National Forest was predicted. However, due to unseasonably cold weather during two critical periods of larval development (mid-September, 1965 and June, 1966), populations on the Targhee were greatly reduced. As a result, the 1965 control project was cancelled.

Since 1965, natural factors have held the infestations at an endemic level. Defoliation was not observed until 1974 when it was noticed to a slight degree in the Pleasant Valley Creek area by foresters from the Dubois Ranger District.

By the summer of 1975, budworm defoliation had greatly increased and was readily visible both on the ground and from aerial observations. The most noticable areas were on the east slopes of the Centennial Mountains west of Henry's Lake, and north of Spencer, Idaho, in the Pleasant Valley Creek area. Particularly heavy egg mass deposition occurred in Pleasant Valley and the Raynolds pass area north of Henry's Lake. High egg mass counts led to predictions of very heavy defoliation for these areas. These predictions were realized and heavy defoliation occurred on approximately 25,000 acres

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in 1976. This sudden and intense increase caused concern to the Forest Supervisor and, consequently, Region 4 Entomologists were asked to conduct an in-depth impact survey. The survey was conducted in conjunction with similar surveys being carried out on the Payette and Boise National Forests in central Idaho. The purpose of the survey was to provide the land manager with data on current and expected defoliation, top-kill, and mortality to both overstory trees and regeneration.

TECHNICAL INFORMATION

INSECT: Western spruce budworm, Choristoneura occidentalis Free.

HOST TREES: Douglas-fir, Pseudotsuga menziesii (Mirb.)

Subalpine fir, Abies lasiocarpa (Hook.) Nutt.

Engelmann spruce, Picea engelmanni Parry.

TYPE OF DAMAGE: Defoliation, top-killing and mortality of host trees.

LOCATION: Targhee National Forest, on the West Division north of Spencer, Idaho, to the Montana State line, and on the East Division, south slope of the Centennial Mountains, west of Henry's Lake.

EXTENT OF INFESTATION: Approximately 25,000 acres of forested land on the West Division from the Forest boundary near Salt Creek, north to east Modoc Creek, northeast to Little Lake Creek, then southeast to Allan Canyon, south to Corral Creek, then west to Salt Creek (Figure 1); and approximately 4,000 acres on the south slope of the Centennial Mountains northwest of Henry's Lake on the East Division (Figure 2).

SURVEY METHODS

The results and conclusions of this evaluation are based upon four independent but closely related surveys. These include aerial, individual stand impact, larval sampling, and egg mass surveys.

Aerial surveys are flown each summer to determine the activity and approximate amount of insect damage throughout the Region. In 1976 the aerial survey of the northern portion of Targhee National Forest was flown and mapped by entomologists from the Ogden Zone on September 8. The budworm infested areas were deliniated and recorded as one of three defoliation categories: light, moderate or heavy.

From the aerial survey maps, seventeen stands were selected for impact evaluations. Eight of these stands were located on the West Division and nine on the East Division. These stands represented each of the three defoliation categories and varied in size from 50 to 100 acres. Transects were marked through each stand at 10-chain intervals, and a plot center was established every 5 chains along each transect. Each plot center was used for both a variable and a fixed-radius plot. A Relaskop at 40 BAF was used to determine "in" trees for the variable plots. "In" trees were recorded by species, dbh, height, and damage rating. Fixed plots, established at the same center point, consisted of all trees less than 5 inches dbh within a 6.8 foot radius (1/300 acre).

Fixed-plot trees were recorded by species and damage class. The species and damage class used were the same for both variable and fixed-plots. Only live trees (and those thought to have been killed by budworm) were recorded for the following species: Douglas-fir, subalpine fir, Engelmann spruce, and lodgepole pine. The damage classes were as follows:

0 = No defoliation
1 = Current year defoliation
2 = Current year plus defoliation of older needles
3 = Less than 10 percent top-kill
4 = 11 to 33 percent top-kill
5 = More than 33 percent top-kill
6 = Complete tree mortality due to budworm

In addition to the variable and fixed-plot data, increment cores were obtained from one stand on each Division, east Dry Creek on the West Division and Lodgepole Ridge on the East Division. These stands were selected because of their mixture of host type (Douglas-fir) and non-host type (lodgepole pine). From each stand, increment cores were obtained from each of 20 Douglas-fir as well as 20 lodgepole pine. These cores were compared and analyzed by covariance to detect how much, if any, growth loss had occurred in host trees by continued budworm defoliation over the past three years of infestation.

Field data was collected during September 21-29. This involved three two-man crews comprised of five persons from the Island Park and Dubois Ranger Districts and one biological technician from Forest Insect and Disease Management, Ogden, Utah.

During the field seasons of 1975 and 1976, permanent plots were established from which budworm larvae and egg mass populations were sampled (Figures 1 and 2). A plot consisted of three condominant Douglas-fir located somewhere in or near the ongoing infestations.

The trees were grouped close together, 50 to 100 feet apart, and were usually located at least 200 feet from any access road. Larval surveys were conducted from July 26-30, 1975, and June 27 - July 10, 1976, by biological technicians from the Ogden Field Office, Forest Insect and Disease Management. From each of the trees in a plot two 18-inch branches were cut with a telescoping pole pruner, from opposite sides at mid-crown. The number of budworm larvae and pupae on each branch was counted and recorded. Other Lepidoptera larvae and pupae were also counted and recorded. The summary for each plot can be found in Tables 1 and 2.

Egg mass sampling was the fourth survey involved in this evaluation. These samples were also collected at each of the permanent budworm plots. Using the telescoping pole pruner, four 70-cm branches were cut at mid-crown on opposite sides from each of the plot's three trees. Of the four branches from each tree, two were used to determine current-year defoliation. The two remaining branches were individually labeled, bagged and shipped to the Forest Insect and Disease Management laboratory in Ogden where each branch was carefully examined for spruce budworm egg masses. Egg masses were tallied, recorded, and summarized for each plot. The standards for predicting defoliation from these egg mass data are shown below:

Number Egg Masses Per Plot	Predicted Defoliation	Damage Category
(70-cm branch)	(Percent)	
0-2	0-25	light
3-6	26-40	moderate
7-24	41-55	heavy
>25	56-100	very heavy

RESULTS AND DISCUSSION

Aerial surveys flown in 1976 indicated an increase in defoliated acreage and intensity over the budworm infested areas of 1975. This increase coincided with the defoliation predictions for 1976 which were based on high egg mass counts taken in the fall of 1975. Larval samples obtained in June of 1975, compared to samples taken from the same plots in July of 1976, also verified this increase in population (Tables 1 and 2).

In order to determine the exact impact of this infestation, 17 plots were closely examined, the data analyzed, and the results summarized into several tables included in this report. Tables 3, 4, 5 and 6

are averages of the stands sampled on each Division. Several facts from these averages are listed below:

West Division

1. Of the total volume, 87.8 percent was Douglas-fir, .2 percent subalpine fire, 3.2 percent Engelmann spruce and 8.9 percent lodgepole pine (Table 3).

2. Of the 150 Douglas-fir per acre, 11.2 percent was undamaged by spruce budworm, 65.5 percent was defoliated to some degree, 23.0 percent had slight to heavy top-kill, and only .3 percent had apparently been killed due to budworm activity (Table 3).

3. Although a few subalpine fir and Engelmann spruce had some degree of top-kill, the amount was insignificant. This is related to their relatively small percentage of the total stand.

4. Generally, as the dbh decreased among the host trees, the extent of damage increased. This was due to the feeding of older larvae which have a tendency to drop out of the upper portions of the overstory when disturbed by wind, rain, etc. This causes a buildup on smaller trees which in turn have proportionately less foliage to support the larger populations of budworm larvae.

5. Analysis of regeneration showed 926.6 trees per acre of which 80.2 percent was Douglas-fir, 6.6 percent subalpine fir, 10.0 percent Engelmann spruce, and 3.2 percent lodgepole pine (Table 5). These data included all trees less than 5 inches dbh, the majority of which were less than 6 inches tall.

6. Although subalpine fir and Engelmann spruce comprised only 16.6 percent of the total regeneration per acre, they were more severely affected than the Douglas-fir.

East Division

1. Of the total volume, 77.9 percent was Douglas-fir, 6.3 percent subalpine fir, 2.1 percent Engelmann spruce and 13.7 percent lodgepole pine (Table 4).

2. Of the 143.8 Douglas-fir per acre, 9.2 percent was undamaged by budworm, 47.7 percent was defoliated to some degree, 29.3 percent had slight to heavy top-kill, and 13.8 percent had apparently been killed by budworm feeding (Table 4).

3. Nearly all of the other host species had suffered some degree of defoliation and moderate amounts of top-kill. No mortality of these other host trees was observed.

4. As with the host trees on the West Division, there was a tendency for the extent of damage to increase as the dbh class sizes decreased.

5. Analysis of regeneration showed 2559.9 trees per acre of which only 7.7 percent was Douglas-fir, 90.1 percent subalpine fir, 1.7 percent Engelmann spruce and .5 percent lodgepole pine (Table 6). Again the majority of these trees was less than 6 inches tall.

6. Of the 2700 other host trees per acre, 70.4 percent were undamaged, 20.6 percent defoliated to some degree, and a mere .8 percent of the subalpine fir top-killed.

Some analogies and comparisons can be made between the sampled stands of these two Divisions. On the average, the selected stands of the West Division contain slightly more volume than those in the East Division. The majority of the volume in these two stands is Douglas-fir, which is the species most severely damaged, and is also the species of most concern to the land manager. Although by volume, only .1 percent of the Douglas-fir has been killed, approximately 60 percent has been defoliated to some extent, and 10 to 15 percent has suffered top-kill.

Analysis of the increment core study indicated that this infestation was causing a significant amount of radial growth loss to Douglas-fir. Those samples taken from the East Dry Creek stand on the West Division showed a 21.1 percent reduction in radial growth over the past three years as compared with the previous three years.

Samples taken from Lodgepole Ridge of the East Division indicated a somewhat higher rate at 25.8 percent radial growth loss for the same six-year period.

Growth reduction is expected to continue and perhaps increase as the infestation spreads and intensifies as was predicted. This prediction was based on the results of the 1975 and 1976 egg mass surveys (Tables 7 and 8). Although these data indicated an overall decrease in population trend from 1975 to 1976, 28 of the 52 plots sampled continued to show a moderate to heavy defoliation prediction. This decrease is a direct function of a similar decrease in the actual number of egg masses counted at each plot. In many cases, this decrease occurred

on plots within heavy to very heavy defoliated areas in which the decrease was not of sufficient magnitude to lower the defoliation prediction. Therefore, several areas within the infestation boundaries were expected to show continued damage in 1977.

Similar surveys carried out in 1977, however, showed spruce budworm defoliation damage and populations to be substantially less than was predicted in 1976. Aerial surveys conducted July 6 and August 4, 1977, indicated the infestation declined in intensity and in area from 1976. The total infested area dropped on the West Division 15,225 acres (39 percent reduction), and on the East Division 1,635 acres (41 percent reduction). Larval samples indicate the budworm population to be down 75 percent on the West Division and 53 percent on the East Division (Tables 9 and 10). Egg mass samples also indicate a population reduction in that 32 of the 43 plots decreased significantly from 1976: 18 of 24 on the West Division and 14 of 19 on the East Division (Tables 11 and 12).

This unexpected drop in budworm population and defoliation is thought to have been the result of abnormal temperatures in the spring of 1977. According to Bailey (1977), April weather in Idaho was extremely dry and unseasonably warm with temperatures averaging near 5^{o} above normal over much of the State. While most of April was unusually warm, subfreezing temperatures were recorded at both the Dubois Experiment Station and the Island Park Dam Station on April 18, 19, and 20. Temperatures then rose to near record highs for two weeks then fell once again to subfreezing levels in early May (Dubois Experiment Station $-6^{o}C$ to $-1^{o}C$, Island Park Dam $-7^{o}C$ to $-1^{o}C$).

These high April temperatures (Dubois Experiment Station 6.6^{o} above normal, Island Park Dam 4.3^{o} above normal) probably enhanced early budworm larval development. However, average May temperatures were lower than normal (Dubois Experiment Station 4^{o} below normal, Island Park Dam 1.9^{o} below normal) which, accompanied by three short periods of subfreezing temperatures, likely killed a high percentage of first, second and possibly third instar larvae. A similar situation occurred in 1966 when an unseasonably warm May followed by subfreezing temperatures in June on the Salmon National Forest killed a high percentage of third and fourth instar larvae (Johnson and Denton, 1975).

RECOMMENDATIONS

While most of the East Division egg mass data indicates light to moderate defoliation in 1978, the egg mass data of the West Division indicates many heavy to very heavy defoliation areas. Therefore it is recommended that these infested areas continue to be monitored throughout the 1978 field season.

Recommended By:

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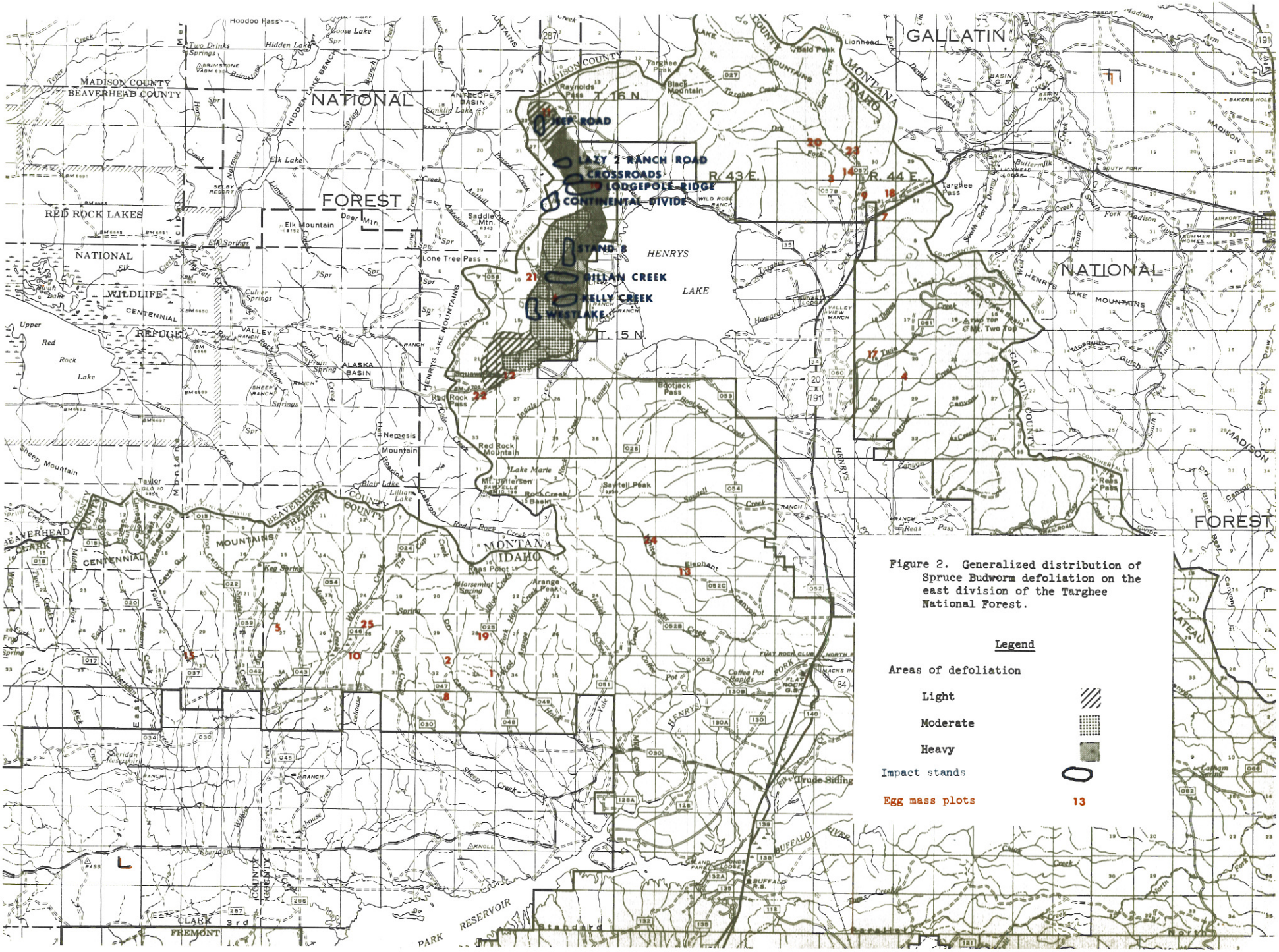
REFERENCES

Bailey, M.H. 1977. Climatological data for Idaho. National Oceanic and Atmospheric Administration, Environmental Service, National Climatic Center. Volume 80, Number 4, 20pp.

Johnson, P.C. and R.E. Denton. 1975. Outbreaks of the western spruce budworm in the American northern Rocky Mountain area from 1922 through 1971. USDA Forest Service General Technical Report. INT-20. 144pp.

APPENDIX


DEEP ROAD
LAZY 2 RANCH ROAD
CROSSROADS
LODGEPOLE RIDGE
CONTINENTAL DIVIDE
STAND 8
DILLAN CREEK
KELLY CREEK
WESTLAKE
HENRYS LAKE
T. 16 N.
T. 15 N.
R. 43 E.
R. 44 E.
MADISON COUNTY
BEAVERHEAD COUNTY
GALLATIN
NATIONAL FOREST
RED ROCK LAKES NATIONAL WILDLIFE REFUGE
CENTENNIAL MOUNTAINS
HENRYS LAKE MOUNTAINS
MONTANA
IDAHO
Figure 2. Generalized distribution of Spruce Budworm defoliation on the east division of the Targhee National Forest.
Legend
Areas of defoliation
Light
Moderate
Heavy
Impact stands
Egg mass plots
13

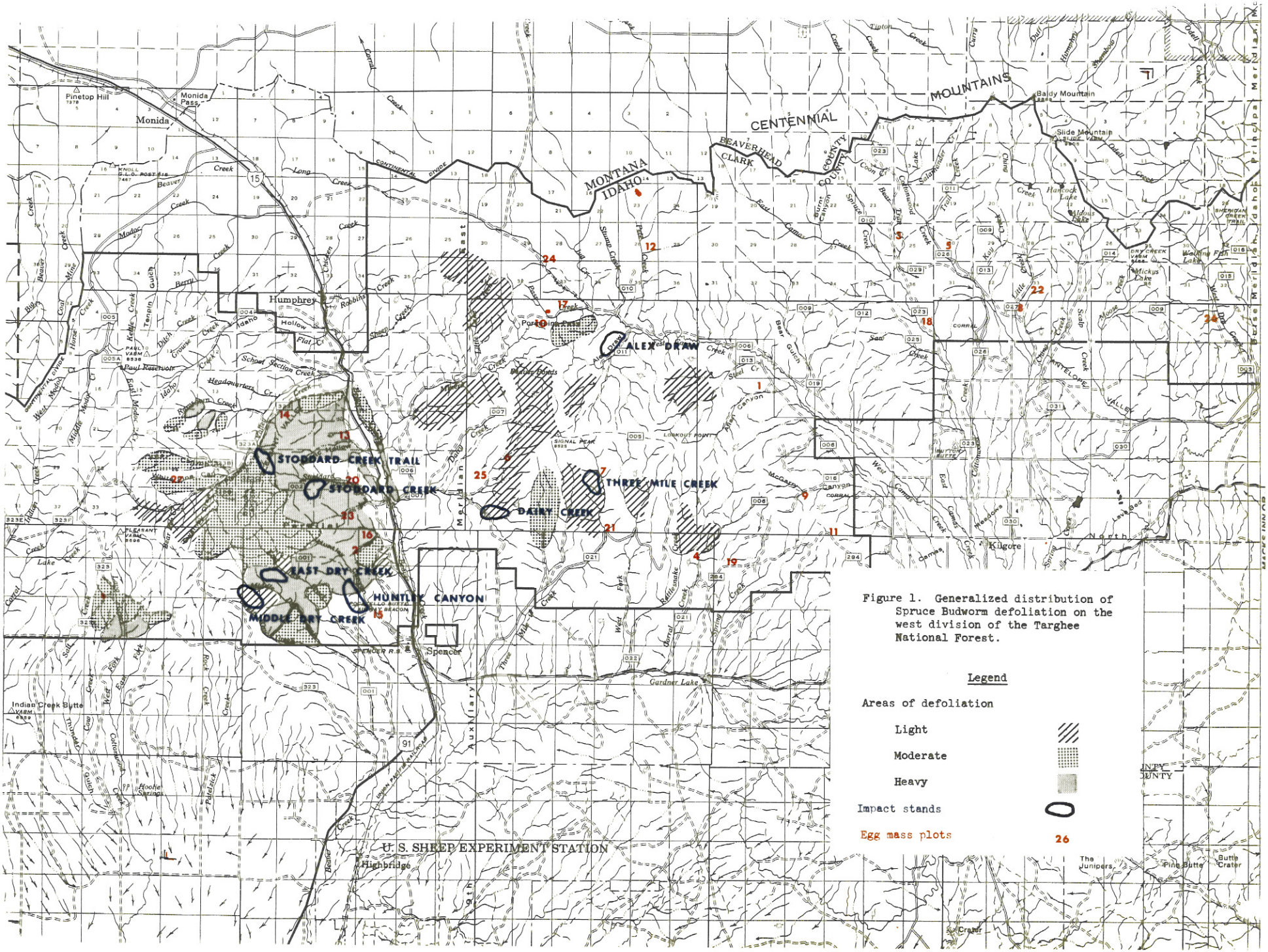


Figure 1. Generalized distribution of Spruce Budworm defoliation on the west division of the Targhee National Forest.

Table 1 Analysis of SBW Population Trend - West Division, Targhee National Forest

Plot Location	1975 No. of Larvae SBW	1975 No. of Larvae Other[1]	1975 No. of Pupae SBW	1975 No. of Pupae Other	1975 Total Per Plot SBW	1975 Total Per Plot Other	1976 No. of Larvae SBW	1976 No. of Larvae Other	1976 No. of Pupae SBW	1976 No. of Pupae Other	1976 Total Per Plot SBW	1976 Total Per Plot Other	TREND SBW	TREND Other
Corral Creek	12	2	6	0	18	2	14	19	0	0	14	10	static	increasing
East Dairy Creek	39	8	24	9	63	17	207	35	0	1	207	36	increasing	increasing
Little Creek	1	0	0	0	1	0	10	3	0	0	10	3	increasing	static
McGarry Canyon	4	6	0	0	4	6	3	48	0	0	3	48	static	increasing
N.E. Miners Creek	49	11	2	1	51	12	72	30	0	0	72	30	increasing	increasing
N.E. Spring Creek	1	9	0	0	1	9	10	8	0	0	10	8	increasing	static
Pete Creek	68	6	11	1	79	7	82	13	0	1	82	14	static	increasing
Picnic Hollow	63	8	20	2	83	10	199	60	0	3	199	63	increasing	increasing
Pleasant Valley Creek	NS[2]						167	106	0	3	167	109	-	-
Porcupine Pass	109	3	2	2	111	5	83	17	0	1	83	18	decreasing	increasing
Saw Creek	31	3	7	1	38	4	10	0	0	0	10	0	decreasing	static
Stoddard Creek	74	9	67	11	141	20	226	36	0	3	226	39	increasing	increasing
Three Mile Creek	13	17	11	5	24	22	21	47	0	1	21	48	static	increasing
Van Noy Canyon	100	5	39	8	139	13	135	37	1	4	136	41	static	increasing
West Dairy Creek	45	13	34	2	79	15	124	37	0	3	124	40	increasing	increasing
West Dry Creek	4	2	1		5	2	1	1	0	0	1	1	static	static
White Pine Canyon	NS						135	106	1	2	136	108	-	-
TOTAL					837	144					1501	652	increasing	increasing
AVERAGE/PLOT					55.8	9.6					88.3	36.8		

1/ Lepidoptera other than spruce budworm
2/ NS: No sample taken

Table 2 - Analysis of SBW Population Trend - East Division, Targhee National Forest

Plot Location	1975 No. of Larvae SBW	1975 No. of Larvae Other 1/	1975 No. of Pupae SBW	1975 No. of Pupae Other	1975 Total Per Plot SBW	1975 Total Per Plot Other	1976 No. of Larvae SBW	1976 No. of Larvae Other	1976 No. of Pupae 3/ SBW	1976 No. of Pupae 3/ Other	1976 Total Per Plot SBW	1976 Total Per Plot Other	TREND SBW	TREND Other
Blue Creek	0	6	0	0	0	6	9	1	0	0	9	1	increasing	decreasing
Dry Creek	NS 2/						7	0	0	0	7	0	-	-
Dry Fork	22	4	7	0	29	4	11	0	0	0	11	0	decreasing	decreasing
Keg Creek	6	7	2	0	8	7	6	1	0	0	6	1	static	decreasing
Kelly Creek	20	3	17	20	37	23	103	41	0	0	103	41	increasing	increasing
Lower Targhee Creek	20	8	22	10	42	18	36	9	0	0	36	9	decreasing	decreasing
Raynold's Pass	42	3	57	9	99	12	64	8	0	0	64	8	decreasing	decreasing
Red Rock Pass	5	4	14	4	19	8	7	12	0	0	7	12	decreasing	increasing
Targhee Creek	27	12	12	1	39	13	3	0	0	0	3	0	decreasing	decreasing
Taylor Creek	NS						0	1	0	0	0	1	-	-
Timber Creek	29	16	75	23	104	39	220	41	0	0	220	41	increasing	increasing
Twin Creek	20	7	1	0	21	7	45	5	0	0	45	5	increasing	static
Upper Red Rock Pass	9	1	2	0	11	1	2	0	0	0	2	0	decreasing	static
Upper Targhee Creek	14	1	0	1	14	2	17	0	0	0	17	0	static	static
Willow Creek	4	8	2	1	6	9	5	0	0	0	5	0	static	decreasing
TOTAL					429	149					535	119	increasing	decreasing
AVERAGE/PLOT					33.0	11.5					35.7	7.9		

1/ Lepidoptera other than spruce budworm
2/ NS: No sample taken
3/ No pupae observed due to the early season sampling

Table 3 - Stand Structure Analysis Trees and Volume Per Acre Of SBW Impact;
Average Of Eight Stands Sampled On The West Division Of The Targhee National Forest, 1976

Average of W.Division	SPECIES												TOTAL ALL SPP.	
DAMAGE CLASS	DOUGLAS FIR			SUBALPINE FIR			ENGELMANN SPRUCE			LODGEPOLE PINE				
	Trees/Ac.	% of Stand	Ave DBH	Trees/Ac.	% of Stand	Ave DBH	Trees/Ac.	% of Stand	Ave DBH	Trees/Ac.	% of Stand	Ave. DBH	Trees/Ac.	% of Stand
0	16.8	9.6	17.7							20.3	11.6	9.5	37.1	21.2
1	48.6	27.7	12.6				.1	.1	22				48.7	27.8
2	49.8	28.4	10.6				1.9	1.1	16.5				51.7	29.5
3	29.8	17.0	9.5	1.5	.9	9.5	1.1	.6	19.0				32.4	18.5
4	3.0	1.7	9.0										3.0	1.7
5	1.8	1.0	6.0										1.8	1.0
6	.5	.3	12.0										.5	.3
TOTAL	150.3	85.7		1.5	.9		3.1	1.8		20.3	11.6		175.2	100.0
	Vol./Ac.	% of Stand	Ave DBH	Vol./Ac.	% of Stand	Ave DBH	Vol./Ac.	% of Stand	Ave DBH	Vol./Ac.	% of Stand	Ave DBH	Vol./Ac.	% of Stand
0	1483.1	13.5	17.7							976.6	8.9	9.5	2459.7	22.4
1	4124.4	37.6	12.6				65.5	.6	22				4189.9	38.2
2	2839.2	25.8	10.6				130.6	1.2	16.5				2993.5	27.0
3	1129.6	10.3	9.5	23.8	.2		152.5	1.4	19.0				1282.1	11.9
4	46.1	.4	9.0										46.1	.4
5														
6	6.5	.1	12.0										6.5	.1
TOTAL	9628.8	87.7		23.8	.2		348.6	3.2		976.6	8.9		10977.8	100.0

TOTAL # OF PLOTS - 17
TOTAL ACRES - 85.6

Table 4 - Stand Structure Analysis (Trees And Volume Per Acre) Of SBW Impact;
Average Of Nine Stands Sampled On The East Division Of The Targhee National Forest, 1976

Ave. of E.Division	SPECIES												TOTAL ALL SPP.	
DAMAGE CLASS	DOUGLAS FIR			SUBALPINE FIR			ENGELMANN SPRUCE			LODGEPOLE PINE				
	Trees/Ac.	% of Stand	Ave DBH	Trees/Ac.	% of Stand	Ave DBH	Trees/Ac.	% of Stand	Ave DBH	Trees/Ac.	% of Stand	Ave. DBH	Trees/Ac.	% of Stand
0	13.2	6.1	9.7	2.4	1.1	9.0	.4	.2	13.0	34.7	16.0	8.8	50.7	23.4
1	16.0	7.4	14.2	10.7	5.0	10.0	.1	.1	22.0				26.8	12.5
2	52.6	24.3	12.9	6.8	3.1	6.7	.2	.1	18.0				59.6	27.5
3	36.8	17.0	10.1	16.0	7.4	8.3	.1	.1	21.0				52.9	24.5
4	3.1	1.4	11.5	1.1	.5	8.0							4.2	1.9
5	2.2	1.0	9.3										2.2	1.0
6	19.9	9.2	6.5										19.9	9.2
TOTAL	143.8	66.4		37.0	17.1		.8	.5		34.7	16.0		216.3	100.0
	Vol./Ac.	% of Stand	Ave DBH	Vol./Ac.	% of Stand	Ave DBH	Vol./Ac.	% of Stand	Ave DBH	Vol./Ac.	% of Stand	Ave DBH	Vol./Ac.	% of Stand
0	223.7	2.7	9.7	8.7	.1	9.0	12.7	.2	13.0	1133.2	13.7	8.8	1378.3	16.7
1	1567.3	19.0	14.2	58.2	.7	10.0	43.8	.5	22.0				1669.3	20.2
2	3304.7	40.1	12.9	45.5	.6	6.7	53.5	.7	18.0				3403.7	41.4
3	1215.7	14.7	10.1	373.1	4.5	8.3	57.4	.7	21.0				1646.2	19.9
4	77.7	.9	11.5	34.8	.4	8.0							112.5	1.3
5	30.7	.4	9.3										30.7	.4
6	7.2	.1	6.5										7.2	.1
TOTAL	6427.0	77.9		520.3	6.3		167.4	2.1		1133.2	13.7		8247.9	100.0

TOTAL # OF PLOTS - 15
TOTAL ACRES - 77

Table 5 - Analysis Of Regeneration
Average Of Eight Stands Sampled On The West Division Of The Targhee National Forest, 1976

Average of W. Division	SPECIES - ALL TREES < 5" DBH								TOTAL	
DAMAGE CLASS	DOUGLAS FIR		SUBALPINE FIR		ENGELMANN SPRUCE		LODGEPOLE PINE		ALL SPP.	
	Trees/Ac.	% of Stand	Trees/Ac.	% of Stand	Trees/Ac.	% of Stand	Trees/Ac.	% of Stand	Trees/Ac.	% of Stand
0	552.6	59.6	31.9	3.4	67.2	7.3	29.7	3.2	681.4	73.5
1	68.4	7.4			16.5	1.8			84.9	9.2
2	110.4	11.9	16.2	1.8					126.6	13.7
3	12.3	1.3	10.6	1.1	2.7	.3			25.6	2.7
4					2.7	.3			2.7	.3
5			2.7	.3					2.7	.3
6					2.7	.3			2.7	.3
TOTAL	743.7	80.2	61.4	6.6	91.8	10.0	29.7	3.2	926.6	100.0

Table 6 - Analysis Of Regeneration
Average Of Eight Stands Sampled On The East Division Of The Targhee National Forest, 1976

Average of E. Division	SPECIES - ALL TREES < 5" DBH								TOTAL	
DAMAGE CLASS	DOUGLAS FIR		SUBALPINE FIR		ENGELMANN SPRUCE		LODGEPOLE PINE		ALL SPP.	
	Trees/Ac.	% of Stand	Trees/Ac.	% of Stand	Trees/Ac.	% of Stand	Trees/Ac.	% of Stand	Trees/Ac.	% of Stand
0	78.8	2.7	2039.0	68.9	44.4	1.5	15.0	.5	2177.2	73.6
1	25.3	.9	558.5	18.9	3.3	.1			587.1	19.9
2	21.1	.7	45.8	1.5	2.2	.1			69.2	2.3
3	27.7	.9	20.5	.7					48.2	1.6
4	5.9	.2	2.2	.1					8.1	.3
5	48.8	1.6							48.8	1.6
6	21.3	.7							21.3	.7
TOTAL	229.0	7.7	2666.0	90.1	49.9	1.7	15.0	.5	2959.9	100.0

Table 7 - Prediction Of Defoliation For 1977 West Division, Targhee National Forest

Area	Plot Location	No. Egg Masses/Plot		Predicted Defoliation For 1977		Trend
		1975 [2]	1976 [3]	Percent	Class	
1 [1]	Allan Canyon	NS [4]	9	41-55	Heavy	- -
2	Beacon Springs	NS	56	56-100	Very Heavy	- -
3	Bear Trap Creek	NS	1	0-25	Light	- -
4	Corral Creek	6	11	41-55	Heavy	Increasing
5	Cottonwood Creek	NS	0	0-25	Light	- -
6	East Dairy Creek	NS	60	56-100	Very Heavy	- -
7	E. Three Mile Creek	NS	36	56-100	Very Heavy	- -
8	Little Creek	1	0	0-25	Light	Static
9	McGarry Canyon	3	0	0-25	Light	Static
10	N.E. Miner's Creek	7	2	0-25	Light	Decreasing
11	N.E. Spring Creek	NS	3	26-40	Moderate	- -
12	Pete Creek	28	2	0-25	Light	Decreasing
13	Picnic Hollow	97	47	56-100	Very Heavy	Decreasing
14	Pleasant Valley Creek	235	83	56-100	Very Heavy	Decreasing
15	Pocatello Butte	NS	20	41-55	Heavy	- -
16	Polk's Pit	NS	87	56-100	Very Heavy	- -
17	Porcupine Pass	42	14	41-55	Heavy	Decreasing
18	Saw Creek	2	0	0-25	Light	Static
19	Spring Creek Ridge	NS	3	26-40	Moderate	- -
20	Stoddard Creek	117	43	56-100	Very Heavy	Decreasing
21	Three Mile Creek	4	3	26-40	Moderate	Static
22	Upper Little Creek	NS	0	0-25	Light	- -
23	Van Noy Canyon	136	46	56-100	Very Heavy	Decreasing
24	West Camas Creek	NS	3	26-40	Moderate	- -
25	West Dairy Creek	45	42	56-100	Very Heavy	Static
26	West Dry Creek	1	1	0-25	Light	Static
27	White Pine Canyon	123	86	56-100	Very Heavy	Static
	TOTAL	847	658			Decreasing
	AVERAGE/PLOT	56.5	24.4			Decreasing

1/ Numbers correspond to the egg mass plot locations on Fig. 1.
2/ Five tree sample plot.
3/ Three tree sample plot.
4/ NS: No sample taken.

Table 8 - Prediction Of Defoliation For 1977 East Division, Targhee National Forest

Area	Plot Location	No. Egg Masses/Plot		Predicted Defoliation for 1977		Trend
		1975[2]	1976[3]	Percent	Class	
1[1]	Blue Creek	4	0	0-25	Light	Decreasing
2	Dry Creek	1	0	0-25	Light	Static
3	Dry Fork	5	1	0-25	Light	Decreasing
4	Jesse Creek	NS[4]	0	0-25	Light	- -
5	Keg Creek	0	2	0-25	Light	Static
6	Kelly Creek	59	19	41-55	Heavy	Decreasing
7	Lower 191	NS	2	0-25	Light	Static
8	Lower Dry Creek	NS	2	0-25	Light	- -
9	Lower Targhee Creek	9	7	41-55	Heavy	Increasing
10	Lower Willow Creek	NS	3	26-40	Moderate	- -
11	Raynold's Pass	147	26	56-100	Very Heavy	Decreasing
12	Red Rock Pass	15	6	26-40	Moderate	Decreasing
13	Sawtell Road	NS	0	0-25	Light	- -
14	Targhee Creek	5	2	0-25	Light	Decreasing
15	Taylor Creek	0	0	0-25	Light	Static
16	Timber Creek	126	59	56-100	Very Heavy	Decreasing
17	Twin Creek	5	0	0-25	Light	Decreasing
18	Upper 191	NS	5	26-40	Moderate	- -
19	Upper Blue Creek	NS	1	0-25	Light	- -
20	Upper Dry Fork	NS	5	26-40	Moderate	- -
21	Upper Kelly Creek	NS	7	41-55	Heavy	- -
22	Upper Red Rock Pass	NS	2	0-25	Light	- -
23	Upper Targhee Creek	NS	4	26-40	Moderate	- -
24	Upper Sawtell Road	NS	0	0-25	Light	- -
25	Willow Creek	0	1	0-25	Light	Static
	Total	376	154			Decreasing
	Average/Plot	28.9	6.1			Decreasing

1/ Numbers correspond to the egg mass plot locations on Fig. 2.
2/ Five tree sample plot.
3/ Three tree sample plot.
4/ NS: No sample taken

Table 9. Spruce Budworm Larvae Per Cluster 1976-1977, Targhee National Forest

AREA (West)	1976	1977	TREND
Corral Creek	14	6	Down
East Dairy Creek	207	72	Down
Little Creek	10	2	Down
McGarry Canyon	3	4	Up
N.E. Miners Creek	72	12	Down
N.E. Spring Creek	10	3	Down
Petes Creek	82	10	Down
Picnic Hollow	199	47	Down
Pleasant Valley	167	41	Down
Porcupine Pass	83	21	Down
Saw Creek	10	0	Down
Stoddard Creek	228	30	Down
Three Mile Creek	21	3	Down
Van Noy Canyon	136	28	Down
West Dairy Creek	136	62	Down
West Dry Creek	1	0	Down
White Pine Canyon	136	34	Down
TOTAL	1515	375	Down 75%
MEAN	89.1	22.1	

Table 10. Spruce Budworm Larvae Per Cluster 1976-1977
Targhee National Forest

AREA (East)	1976	1977	TREND
Blue Creek	9	1	Down
Dry Creek	7	4	Down
Dry Fork	11	14	Up
Keg Creek	6	4	Down
Kelly Creek	103	18	Down
Lower Targhee Creek	36	27	Down
Raynold Pass	64	57	Down
Red Rock Pass	7	16	Up
Targhee Creek	3	--	
Taylor Creek	0	3	Up
Timber Creek	220	76	Down
Twin Creek	45	18	Down
Upper Red Rock Pass	2	2	---
Upper Targhee Creek	17	7	Down
Willow Creek	5	3	Down
TOTAL	535	250	Down 53%
MEAN	35.7	17.9	

Table 11. Prediction of Defoliation for 1977 and 1978, West Division, Targhee National Forest.

AREA (West)	Predicted Defoliation 1977		Predicted Defoliation 1978		TREND
	Egg Masses/plot	Damage Class	Egg Masses/plot	Damage Class	
Allen Canyon	9	Heavy	22	Heavy	Up
Beacon Springs	56	Very Heavy	60	Very Heavy	Up
Bear Trap Creek	1	Light	0	-----	Down
Corral Creek	11	Heavy	2	Light	Down
Cottonwood Creek	0	-----	0	-----	---
East Dairy Creek	60	Very Heavy	54	Very Heavy	Down
East Three Mile Creek	36	Very Heavy	15	Heavy	Down
Little Creek	0	-----	2	Light	Up
McGarry Canyon	0	-----	4	Moderate	Up
Northeast Miner's Creek	2	Light	1	Light	Down
Northeast Spring Creek	3	Moderate	0	-----	Down
Pete's Creek	2	Light	0	-----	Down
Picnic Hollow	47	Very Heavy	30	Very Heavy	Down
Pleasant Valley Creek	83	Very Heavy	48	Very Heavy	Down
Pocatello Butte	20	Heavy	24	Heavy	Up
Polk's Pit	87	Very Heavy	45	Very Heavy	Down
Porcupine Pass	14	Heavy	6	Moderate	Down
Saw Creek	0	------	0	-----	Down
Spring Creek Ridge	3	Moderate	30	Very Heavy	Up
Stoddard Creek	43	Very Heavy	11	Heavy	Down
Three Mile Creek	3	Moderate	2	Light	Down
Upper Little Creek	0	-----	0	-----	---
Van Noy Canyon	46	Very Heavy	16	Heavy	Down
West Camas Creek	3	Moderate	3	Moderate	---
West Dairy Creek	42	Very Heavy	28	Very Heavy	Down
West Dry Creek	1	Light	0	-----	Down
White Pine Canyon	86	Very Heavy	29	Very Heavy	Down
MEAN	24.4	Heavy	16.0	Heavy	Down

Table 12. Prediction of Defoliation for 1977 and 1978, East Division, Targhee National Forest

AREA (East)	Predicted Defoliation 1977		Predicted Defoliation 1978		TREND
	Egg Masses/plot	Damage Class	Egg Masses/plot	Damage Class	
Blue Creek	0	-----	0	-----	---
Dry Creek	0	-----	1	Light	Up
Dry Fork	1	Light	1	Light	---
Jesse Creek	0	-----	2	Light	Up
Keg Creek	2	Light	1	Light	Down
Kelly Creek	19	Heavy	12	Heavy	Down
Lower 191	2	Light	0	-----	Down
Lower Dry Creek	2	Light	2	Light	---
Lower Targhee Creek	7	Heavy	1	Light	Down
Lower Willow Creek	3	Moderate	0	-----	Down
Raynolds Pass	26	Very Heavy	13	Heavy	Down
Red Rock Pass	6	Moderate	5	Moderate	Down
Sawtell Road	0	-----	0	-----	---
Targhee Creek	2	Light	1	Light	Down
Taylor Creek	0	-----	0	-----	---
Timber Creek	59	Very Heavy	18	Heavy	Down
Twin Creek	0	-----	3	Moderate	Up
Upper 191	5	Moderate	3	Moderate	Down
Upper Blue Creek	1	Light	4	Moderate	Up
Upper Dry Fork	5	Moderate	2	Light	Down
Upper Kelly Creek	7	Heavy	1	Light	Down
Upper Red Rock Pass	2	Light	0	-----	Down
Upper Targhee Creek	4	Moderate	3	Moderate	Down
Upper Sawtell Road	0	-----	0	-----	---
Willow Creek	1	Light	2	Light	Up
MEAN	6.2	Moderate	3.0	Moderate	Down